

8 Data Toss



Because of differences among individuals, a **range**, or set of values, is often used to describe the variation in normal results found in a larger group of people. For example, you may have had nurses take your pulse. What can your pulse tell them? Through scientific study, a normal pulse range for people at rest has been established. The normal range for adults is 60–80 beats per minute. The use of a range (60–80) instead of a specific number helps take into account the differences among people.

To establish a range, data are collected from many trials. Increasing the number of people tested increases the chance that the conclusions are true for most people.

If you play baseball, softball, or other games that involve throwing and catching, your teacher or coach may tell you to catch the ball with two hands. Does catching with two hands (as compared to one) really increase your ability to catch a ball?



CHALLENGE



How can you study people scientifically? Find out by collecting data on people and then designing your own experiment.

MATERIALS



For each pair of students

- 1 porcupine ball



For each student

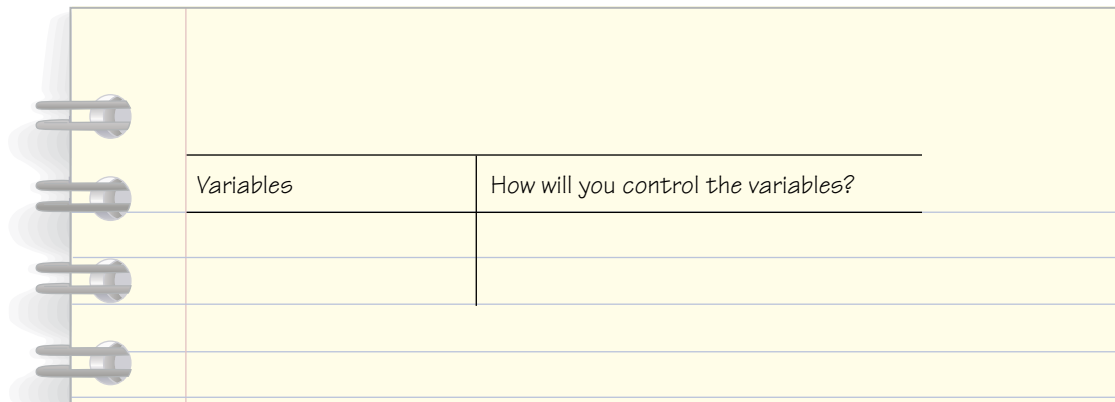
- 1 Student Sheet 8.1, "Data Tables for Part A"
- 1 Science Skills Student Sheet 5, "Elements of Experimental Design"
- 1 Literacy Student Sheet 1b, "Writing a Formal Investigation Report"

Student Sheet 1.1, "Anticipation Guide: Ideas about Experimental Design," from Activity 1

PROCEDURE

Part A: One Hand Compared to Two

1. Based on what you know about catching balls, record a hypothesis about whether the ability to catch a ball increases when using two hands (as compared to one).
2. With your partner, brainstorm all of the variables that you will try to keep the same while conducting the experiment.
3. As a class, discuss the variables you will keep the same. Draw a larger version of the chart below in your science notebook. Record the variables your class has decided on and how your class has decided to control them.



| | |
|-----------|-------------------------------------|
| | |
| Variables | How will you control the variables? |
| | |
| | |
| | |
| | |

4. Stand 2–3 meters away from your partner, as directed by your teacher.
5. Have your partner toss you the ball while you catch it using only one hand. Remember to keep all variables, except for the one being tested, the same.
6. *Did you find catching the ball with one hand easy, difficult, or somewhere in between?* Record your response in Table 1, “My Data,” of Student Sheet 9.1, “Data Tables for Part A.”
7. Have your partner toss you the ball 20 times while you continue to catch it using only *one hand*. Record the results of each catch in Table 2, “My Data: Number of Completed Catches.” Place an “X” in the box when you catch the ball using one hand, and an “O” when you do not. When you are done, count and record the total number of completed catches.
8. Repeat Steps 4–7, but use *two hands* to catch the ball.
9. Now repeat Steps 4–8 for your partner to collect his or her own data.

10. Share your results with the class. Use the class data to complete Tables 3 and 4 on Student Sheet 9.1.
11. Complete Analysis Questions 1–4.

Part B: Designing Your Own Experiment

12. Design an experiment to investigate the effect of one variable on your ability to catch a ball. For example, you may want to investigate your ability to catch with one eye closed, to compare your ability to catch with your right or your left hand, or to vary the size of the ball. When designing your experiment, think about the following questions:
 - What is the purpose of your experiment?
 - What variable are you testing?
 - What is your hypothesis?
 - What variables will you keep the same?
 - How many trials will you conduct?
 - Will you collect qualitative and/or quantitative data? How will these data help you to reach a conclusion?
 - How will you record these data?

Look at the list of variables you identified in Part A for additional ideas.

13. Record your hypothesis and your planned experimental procedure in your science notebook.
14. Make a data table that has space for all the data you need to record. You will fill it in during your experiment.
15. Obtain your teacher's approval of your experiment.
16. Conduct your experiment and record your results.
17. If you have time, switch procedures with another pair of students. Conduct their experiment and record the results while they do the same with yours. Then exchange results so that each pair has two sets of results for the experiment they designed.

EXTENSION

Conduct your experiment with different age groups, such as children compared with adults. Compare your data with the data collected in class. Are your conclusions the same?

ANALYSIS

Part A: One Hand Compared to Two



1. Explain whether your own data supported or disproved your hypothesis about the ability to catch a ball with two hands (as compared to one).



2. Look at the class data on Student Sheet 8.1.
 - a. In Table 4, what was the range of students' ability to catch a ball with one hand?
 - b. In Table 4, what was the range of students' ability to catch a ball with two hands?
 - c. Use the class data to explain whether the ability to catch a ball increases when using two hands (as compared to one).
3.
 - a. What qualitative data did you collect in Part A of this activity?
 - b. What quantitative data did you collect in Part A of this activity?
 - c. Which type of data was more useful for comparing results among the class members?
4. Fill in the "After" column for statements 17–19 on Student Sheet 1.1, "Anticipation Guide: Ideas about Experimental Design." Did your thinking change?
5. Your coach asks you whether she should continue to recommend that players on the team catch with two hands. Explain your recommendation and whether it is based on your own data or that of the class.

Part B: Designing Your Own Experiment



6. Prepare a full report for the investigation according to the guidelines on Literacy Student Sheet 1b, "Writing a Formal Investigation Report." Write your report on a clean sheet of paper.

The analysis section of your report should include the following:

- a. a graph of your results
- b. a discussion of the variables you were able to keep the same
- c. a discussion of the variables (except the one being tested) that you could not keep the same



7. Was it possible for another pair to repeat your experiment? Were the results similar to your original results? Explain.



8. How do scientists use good experimental design to collect reproducible data about people?